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INSTITUTE OF GAS TECHNOLOGY

THE GAS INDUSTRY'S OWN EDUCATIONAL AND RESEARCH FACILITY

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GAS ABSTRACTS

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1. GAS INDUSTRY

Energy Uses and Supplies

Barnett, H. J. ENERGY USES AND SUPPLIES, 1939, 1947, 1965. U.S. Bureau of Mines Information Circular 7582 (1950) October.

This report summarizes the results of an exploratory study of energy uses and supplies in the U.S. Availability and consumption of energy are described in tabular and graphical form. Their projection to 1965 is presented as an example to assist planning and policy officials by describing the concepts and statistical methods. The total energy of primary mineral fuels and water power is broken down into the individual component energies and their trends of supply, use, and efficiency. Their functional requirements in the yield of national products in the forms of heat, motion power, stationary power, and non-fuel energy commodities are discussed and derivation of indexes is described.

O. P. Brysch

Gas Sales in Minneapolis

Wrench, H. K. HOW MINNEAPOLIS BUILT ITS NATURAL GAS SALES. *Gas Age* **106**, 32-38, 70, 72 (1950) *November* 23.

The author presents an analysis of the manner in which the Minneapolis Gas Company has tripled its revenues in the last 14 years. The availability of natural gas made the expansion in service possible.

J. D. Parent

Pipe Lines

Reed, P. $117,800,000 GAS LINE. *Oil Gas J.* **49**, 56 (1950) *December* 7.

Texas Eastern Transmission Corp. is planning to build a line 805 miles long and 30 inches in diameter from Mississippi to Pennsylvania. Capacity is to be 476 MMcf per day. United Gas Pipe Line Co. is to be the supplier and Algonquin Gas Transmission Co. is to be the principal recipient of the gas. Underground storage facilities in Pennsylvania will permit an annual load factor of 97%. Cost of the project is $118,000,000.

J. D. Parent

APPROVE $140 MILLION NORTHEASTERN PROJECT FOR NEW ENGLAND GAS. *Pipe Line News* **22**, 9-11 (1950) *December.*

The FPC has issued an opinion and order authorizing Northeastern Gas Transmission Co., of Boxton, Mass., to supply part of the New England area with natural gas. The FPC stated it was of the opinion that the balance of the markets should be served by Algonquin Gas Transmission Co., also of Boston, upon a showing that it has an adequate supply of gas. The Commission also authorized Tennessee Gas and Transmission Co., Transcontinental Gas Pipe Line Corp. and New York State Natural to build pipe line facilities. Tennessee is to carry out a $118,644,000 expansion.

J. D. Parent

Rates

Falvey, J. F. SURVEY SHOWS STATE COMMISSION TREND TOWARD 'FAIR VALUE' RATE BASES. *Am. Gas J.* **173**, 18-20 (1950) *October.*

The evidence points to a decided swing of the rate pendulum in the utilities' favor. Recent court decisions in two states, and a decided swing in commission thinking in another, give ample evidence of permitting utilities to reflect in their rate base the continuing rise in construction costs. Equally important, the majority of state regulatory commissions do recognize the necessity for allowing utility companies' earnings on the rate base sufficient both to adequately service existing capitalization and to attract at an advantageous yield rate the new capital needed for further plant expansion.

Excerpt from article

Safety

Corfield, G. TECHNICAL TRENDS: A MIRACLE OF SAFETY. *Gas* **26**, 21 (1950) *December.*

The October, 1950, NFPA quarterly report has classified 580,000 fires which were recorded during 1949. Gas and appliances were responsible for less than 1% of the total, which is remarkable in view of the quantities of gas used.

J. D. Parent

Seasonal Demand

Oates, J. F., Jr. HOW TO FILL SUMMER LOAD VALLEYS: WHAT RATE SHALL BE FIXED? *Gas Age* **106**, 42-44, 72, 74, 76 (1950) *December* 7.

Methods generally employed for keeping capacity in step with seasonal demand are reviewed. The manner in which Peoples Gas Light & Coke Co. in Chicago has handled its peak load problem is presented in detail. Cost allocation for different types of service is discussed.

J. D. Parent

Synthetic Fuels

Boyd, J. PETROLEUM INDUSTRY HAS DEFINITE ROLE IN SYNTHETICS DEVELOPMENT. *Petroleum Refiner* **29**, 77-85 (1950) *December.*

Our economy in peace and in war is based to a large extent upon an ample supply of fuel energy. Conversion of coals and oil shales to liquid fuels is believed near at hand. The Bureau of Mines is presently engaged in research on many aspects of the problem. It is anticipated that the petroleum industry will play a major role in the construction and operation of a new synthetic liquid fuel industry.

C. H. Riesz

Wellhead Price Fixing

Crosby, S. H. SWEEPING PRICE INCREASES FORESEEN IF HIGH COURT UPHOLDS WELLHEAD PRICE FIX. *Gas* **26**, 84-87 (1950) *December.*

The problem of minimum well-head price fixing of natural gas by states is discussed. It is maintained that companies may benefit by this practice. The decision of the Supreme Court has not yet been given.

J. D. Parent

2. APPLIANCES

Burners

INVESTIGATION OF THE EFFECT OF GAS FLAME IMPINGEMENT ON COMBUSTION CHARACTERISTICS OF DOMESTIC RANGE TOP AND WATER HEATER BURNERS. Research Bulletin 59. Am. Gas Assoc. Committee on Domestic Gas Research Project DGR-4-B (1950) November.

A study of carbon monoxide formation from incomplete combustion of gaseous flames has been made. Three types of gases were used, natural gas, mixed gas and manufactured gases. All tests were made under constant aeration, flames impinging on ceramic and metal surfaces. The variables studied were temperature and nature of impinging surface, distance between burner and impinging surface, angle of flame from vertical, and type of gas.

D. L. Nicol

4. CARBONIZATION AND GASIFICATION

Air-Drying Solids

Hendry, R. and Scott, A. W. SOME FUNDAMENTAL ASPECTS OF AIR-DRYING OF SOLIDS. *J. Inst. Fuel* (British) **23**, 286-294 (1950) *November.*

This comprehensive article consists of a review of general drying theory and examination of some experimental data. The properties of air-water vapor mixtures are summarized and the construction of a psychrometric chart is described. The application of the chart to design calculations is illustrated by solving a problem involving two-stage drying with recirculation. Experimental data have been presented most successfully by the nomographic method, since the wet-bulb depression coefficient and integration methods are somewhat limited in application. An attempt is being made to correlate the existing data on drying. Some of the problems involved in such a classification are discussed; some of these are effect of air velocity, drying during falling-rate periods, and both the critical and equilibrium moisture contents.

W. E. Ball

Carbonization

Carr, J. and Marsden, A. THE GAS INDUSTRY: TODAY AND TOMORROW. *Inst. Gas Engrs. Communication* **366** (1950) *June.*

Raw materials for gas manufacture are reviewed with particular emphasis on the effects of coal quality on plant life and coke market. With rising gas-oil cost the possible use of creosote for carbureting is suggested. Detailed discussion is presented on present plant practices and processes for the manufacture of coal gas and carbureted water gas, purification of these gases and disposal of effluents. In an effort to assess permissible variations of heating value and specific gravity from their respective declared values, a study of three plants (two coal gas-carbureted water gas plants and one coal gas-producer gas plant) was made which indicated that specific gravity fluctuations amounted to more than $\pm 10\%$ from normal. The Wobbe Index (Calorific value/$\sqrt{\text{specific gravity}}$) which is a measure of the energy supplied by a burner, was recommended as a criterion for gas quality. The complex aspects of the organization of the gas industry are also considered.

C. Von Fredersdorff

Barritt, D. T. and Kennaway, T. PROGRESS REVIEW NO. 13. COAL CARBONIZATION —COKE-OVEN PRACTICE. *J. Inst. Fuel* (British) **23**, 308-312 (1950) *November.*

Progress in coke-oven practice, primarily British, is reviewed. The recent work on relationship of coal properties and small-scale tests to behavior in the oven is discussed and the lack of a completely satisfactory theory of the coking mechanism is pointed out. Blending practice and coal handling improvements are reviewed, with mention of the first British installation of bed-blending. No fundamental change in basic design of coke ovens can be reported although many improvements in details of strength, heat insulating, operators' comfort and ease of control are noted. Free expansion walls, block-design of batteries, improved refractories, oven-end insulation, self-sealing doors and oven repair techniques are briefly discussed as are improved details in coke oven machinery. In the ammonia recovery field, modified crystallization methods and new materials of construction have been successful. Bubble cap washers, pipe-still benzol strippers and wash oil regenerating methods have been introduced in light oil recovery, and Linde plant liquefaction has been used in separation of gaseous hydrocarbons. Hydrogen sulfide removal by the Manchester and the Staatsmijnen Otto processes are mentioned.

O. P. Brysch

Wallace, G. W. CARBONIZATION APPARATUS. U.S. 2,531,998 (1950) November 28.

An apparatus is described for the carbonization of coal, peat or shale comprising a closed carbonizing chamber having for a bottom a frontward- and downward-sloping, perforated, refractory grate. Feed material of graded size from a divided sealed vertical bin can be fed as a double layer onto the upper rearward edge of the grate and is shoved mechanically and intermittently down the sloped grate to meet hot combustion gases introduced through the front wall above the grate. These gases are sucked downward through the 18-inch layer on the grate, thereupon carbonizing the material, and into laterally placed chambers below the grate to a collecting header. Adjustment of suction in the several lateral chambers provides zones of controlled intensity of carbonization. Byproducts are recovered conventionally from the gases. The carbonized product (activated carbon, char, coke) falls from the front edge of the grate to a sealed-discharge bin.

O. P. Brysch

Catalytic Reforming

Holman, O. B. CYCLIC CATALYTIC REFORMING. *Gas* **26**, 36-37 (1950) *December.*

The cyclic catalytic reforming process installed in Station A of the Philadelphia Gas Works Company and its performance is briefly described. To date, shut-down time has been less than 1% of the running time. Natural gas reformed by this method into a 530 Btu product is indicated to be 3½ —4 cents per Mcf less expensive than fuel bed reforming. Nitric oxide in the make gas was only about 1 gram per MMcf and naphthalene was about 1 grain per Ccf. The hydrogen sulfide of the product gas was about 0.5 grain per Ccf. No evidence of lampblack has been found.

C. H. Riesz

Coal Preparation

Hager, H. J. ABC TYPIFIES TREND TO MECHANIZED MINING AND COAL PREPARATION. *Mining Eng.* 187, 1244-1248 (1950) *December.*

Coal and coke operations of the Alabama By-Products Corp. of Birmingham, Alabama are briefly described. Seven mines operate in the Mary Lee and the Black Creek seams. Detailed descriptions of operations at the Barney and Praco mines are given with flow-sheets of coal preparation plants and data on washability.

O. P. Brysch

Coal Properties

Jowett, G. H., Price, P. H. and Sarjant, R. J. AN INVESTIGATION INTO THE RELATIONS BETWEEN GRAY-KING ASSAY, CRUCIBLE SWELLING NUMBER, AND PERCENTAGES HYDROGEN AND CARBON IN SOUTH YORKSHIRE COALS. *J. Inst. Fuel* (British) 23, 304-307 (1950) *November.*

A statistical study is reported of three variables of South Yorkshire coals, the Gray-King Assay Coke Type, the Crucible Swelling Number and the ultimate analysis (carbon and hydrogen). Graphs for estimation of the two former from the carbon and hydrogen are presented, and also for estimating the Gray-King Coke Type from the other three variables. Graphs of the observed vs. the estimated Gray-King Index show the latter to be most accurate ($R = 0.88$) when estimated from C, H and swelling number. Tabulated data for 90 coals is given.

O. P. Brysch

Coke Plants

DeCarlo, J. A. and Corgan, J. A. THE POSSIBLE EFFECT OF THE EXPANDING USE OF NATURAL GAS ON THE PRODUCTION OF COKE AND COAL CHEMICALS IN THE UNITED STATES. U.S. Bureau of Mines Information Circular 7579 (1950) September.

The coke plants most likely to be affected by the introduction of natural gas into an area are those classified by the Bureau of Mines as gas utilities and merchant operations. The quantities of coke and coal chemicals produced by these plants are substantial, although there has been a steady decline in proportion of coal products produced by them to the national total. In 1948, the output of coke from these plants totaled 13,332,499 net tons, or nearly 20 per cent of the total oven coke produced in the United States. All of the plants that contributed to this tonnage were canvassed to determine the possible effect that the substitution of natural gas for coke-oven gas might have on their continued operations. The replies were analyzed and the result indicated that five plants and one battery at another, which operated in 1948, expect to discontinue operations as soon as natural gas is introduced. These plants, which operated 310 ovens with an annual coke capacity of 1,298,400 net tons, produced 1,285,371 tons of coke in 1948. Thus, about 10 per cent of the annual coke production of the merchant and gas utility companies and 2 per cent of the total United States annual coke capacity is expected to be lost because of the substitution of natural gas for coke-oven gas within the next 5 years. There is a possibility, however, that several of the larger plants now operated by gas utility companies may be sold to other interests, and that the coke plants will continue to operate.

Excerpt from article

Cracking Hydrocarbons

Shapleigh, J. H. (assigned to Hercules Powder Co.) METHOD OF CRACKING HYDROCARBONS. U.S. 2,525,276 (1950) October 10.

A process is patented for thermally cracking all types of hydrocarbons, including crudes, in alloy tubes at a high degree of atomization and high steam/oil ratios for the production of gaseous olefins.

H. R. Linden

Gas Producers

Gibson, J. W. and Burke, S. A. THE EFFECT OF VARYING THE DEPTH OF FUEL BED IN GAS PRODUCERS. *J. Inst. Fuel* (British) 23, 303 (1950) *November.*

These comments upon an earlier paper by Brzozowski, et al (*J. Inst. Fuel* 23, 255-262, November, 1950) deal with the determination and the maintenance of an optimum depth of fuel bed. Once established, the maintenance of proper ash and fire zones more than doubled the throughput and raised the calculated calorific value of the gas from 145 to 156 Btu in an anthracite fired Power Gas producer. With production of hot raw gas using bituminous coals, the effect of increasing bed depth is likely to be greater than with anthracite.

O. P. Brysch

GAS PRODUCER RESEARCH MAKES PROGRESS. *Ind. Heating* 17, 1528, 1530, 1532 (1950) *September.*

In a cooperative sponsored project to develop a high capacity producer for the gasification of caking and non-caking coal, three types of equipment are being investigated; namely, (a) cross current producer, (b) Modified Flesh-Winkler or down-draft producer, and (c) continuous double zone producer with slag tap. Methods of rapidly igniting and de-caking bituminous coal charges is under study.

C. Von Fredersdorff

Gasification

Chetrick, M. H. UNDECOMPOSED STEAM IN LIGNITE GASIFICATION. U.S. Bureau of Mines Report of Investigations 4738 (1950) October.

Experimental data obtained in the gasification of lignite by steam in an externally heated retort were correlated with the fraction undecomposed steam as the independent variable. Other possible variables of the process such as temperature, pressure, character of carbon, and time of contact between steam and lignite were either relatively constant or produced no significant effects on the gasification results. Gas compositions and heating values as well as the volume gas produced per lb. carbon gasified are presented in graphical and tabular form.

C. Von Fredersdorff

Rollman, W. F. (assigned to Standard Oil Development Co.) METHOD OF PRODUCING A CARBON MONOXIDE AND HYDROGEN GAS MIXTURE FROM CARBONACEOUS MATERIALS. U.S. 2,527,197 (1950) October 24.

Hydrogen and carbon monoxide are produced from a solid fuel in a fluidized form by passing steam over the hot fuel. The reaction vessel is cylindrical and is divided into eight segments, two segments being used for the steam-carbon reaction, two for the oxidation reaction and four interposed segments being used as neutral zones. The process is claimed to be continuous, does not require pure oxygen, produces minor amounts of nitrogen and carbon dioxide and is done with relatively simple equipment.

W. J. Merwin

Rollman, W. F. (assigned to Standard Oil Development Co.) APPARATUS FOR GASIFYING CARBONACEOUS SOLIDS. U.S. 2,527,198 (1950) October 24.

The equipment for carrying out the steam-carbon reaction is patented. It consists of a cylindrical vessel with eight segments which can be used for steaming or burning fuel.

W. J. Merwin

Rutherford, R. W. PROGRESS REVIEW NO. 10: RECENT DEVELOPMENTS IN GASIFICATION. *J. Inst. Fuel* (British) 23, 209-213 (1950) *July.*

Producer gas practice has been improved through the use of mechanical charging and levelling devices to obtain better distribution of the fuel charge. The effect of fines in decreasing the tar content of producer gas has been studied. Mechanical producers have continued to replace the step-grate type in firing retort settings, although the former is more expensive to operate. A study of the effect of blast temperature on producer gas efficiency indicated an increase of 3 Btu per cu ft heating value for every 100°C blast superheat. Oxygen enriched blast in producers of conventional design for the production of a synthesis gas has been the subject of recent papers. Producer gas having 46% by volume combustibles was from logs up to 18 in. in diameter and containing up to 45% moisture. This gas, having a heating

value of approximately 150 Btu/cu ft and yielding a cold gas efficiency of 60% was used in ammonia synthesis. Through the use of increased blast rates and gas oil admission in both carbureter and generator, and with the improvement of automatic operators, a considerable increase in carbureted water gas set capacity was achieved. Developments are reported on reforming of refinery oil gases and in the elimination of hard side wall clinker in carbureted water gas sets. Progress has been made in the production of water gas from coal in a system of three fluidized vessels in which 800°C carbonization, air blowing and steam blowing occur in succession. Reference is made to the production of high Btu oil gas by the Twin Generator, Hall High Btu and South Eastern Gas Board Catalytic processes. Coal gasification by oxygen enriched blast has been successful in the Thyssen-Galocsy and Luena slagging type generators. Interest in high pressure gasification of reactive non-caking fuels by the Lurgi generator has developed in Australia and Great Britain. The gasification of pulverized coal in the fluidized state has been achieved in the Winkler generator. Suspension gasification of coal dust with steam and oxygen has developed considerable interest and work is reported on the Koppers process by the U.S. Bureau of Mines, on the vortex process by the Fuel Research Board and U.S. Bureau of Mines, and on the cyclone process by the Institute of Gas Technology.

C. Von Fredersdorff

Savill, A. H. DEVELOPMENTS IN GAS PRODUCTION PRACTICE. *Gas World* (British) 132, 126-130 (1950) *July* 29.

Recent experience with simultaneous oil gasification in horizontal retorts has shown a considerable saving in coal for the production of a 500 to 600 Btu city gas. Improvement in operational practice by substitution of a scrubber standpipe for the usual ascension offtake pipe system on retort benches has simplified gas collecting mains and eliminated plugging difficulties. Consideration has been given to the recirculation of waste gas to increase capacity and prolong the refractory life of retort settings. In several instances mechanical grate producers have been substituted for the usual step-grate type used in heating the retorts, with the resulting advantages that the producer gas-fired type has an almost constant calorific value, the operation is easier to control, manual clinkering is eliminated and combustion flues and waste heat boiler tubes are kept cleaner. A survey of data on dry cooling of coke to recover sensible heat for steam raising in intermittent carbonizing plants disclosed that dry cooling equipment can give reliable service but its usefulness is dependent on regularity of hot coke feed and that it is more economical to consider dry cooling for new coke ovens rather than existing horizontal and vertical retorts. Due to increasing difficulties in obtaining personnel for the dumping and maintenance of dry oxide purifiers, the problem of replacing these purifiers by a continuous wet process has received considerable attention. The absorption process using alkaline carbonate followed by oxidation of H_2S to sulfur or to a thiosulfate seems most favorable for application in England.

C. Von Fredersdorff

Strimbeck, G. R., Holden, J. H., Rockenback, L. P., Cordiner, J. B., Jr. and Schmidt, L. D. PILOT-PLANT GASIFICATION OF PULVERIZED COAL WITH OXYGEN AND HIGHLY SUPERHEATED STEAM. U.S. Bureau of Mines Report of Investigations 4733 (1950) November.

Pilot-plant data are reported on the gasification of a strongly coking Sewickley-bed coal with oxygen and with superheated steam in the temperature ranges 230 to 250°F, 1600 to 2000°F, and 2700 to 3400°F. Thirty-one runs were made with a coal feed particle size of 90% through 200 mesh, at feed rates of 200 to 450 lb/hr. Average requirements per Mcf of $CO+H_2$ as a function of superheated steam temperature are

Steam Temp. °F	Coal, lb.	Oxygen, SCF	Steam, lb.
2904	33.3	171	81.1
1899	37.3	326	42.5
238	42.3	394	29.1

The data show the advantage of superheated steam in decreasing the oxygen required for gasification. Average percentage carbon gasified was 88.9, 89.9 and 85.2 in the high, medium and low temperature steam runs respectively.

Correlations of the operating variables indicate an approximately linear dependence of per cent carbon gasified on total equivalent oxygen in the gasifying medium. Other correlations are presented on steam decomposition, oxygen required per Mcf of $CO+H_2$ in the make gas, per cent CO_2 and H_2/CO ratio in the make gas. The experimental work was conducted using a cylindrical high temperature refractory lined reactor having tangential inlets for the coal, oxygen and steam streams and in which provision was made for withdrawing fused ash. The main auxiliary equipment consisted of two Royster pebble heaters for producing the superheated steam, two fluidized coal feed vessels and a series of cyclone separators for dust removal. Flow diagrams and photographs are included.

C. Von Fredersdorff

Humic Acids from Coal

Friedman, L. D. and Kinney, C. R. HUMIC ACIDS FROM COAL. CONTROLLED AIR-OXIDATION OF COALS AT 150° to 400°C. *Ind. Eng. Chem.* 42, 2525-2529 (1950) *December.*

Results of controlled oxidation by air of representative samples of coals of all ranks at various temperatures are described. Bituminous coals at an optimum oxidation temperature of 200°C gave yields of 90% or over of alkali-soluble coal acids, and 80 to 85% of humic acid-like products. Lignite and subbituminous coals, though easily oxidized, gave lower yields of acids. Anthracite required higher temperatures and gave products of low alkali solubility. Details of product yield at various periods of oxidation up to 300 hours, and at various temperatures, are presented graphically.

O. P. Brysch

Moisture in Coal

Barber, E. G. THE DETERMINATION OF MOISTURE IN COAL. *J. Inst. Fuel* (British) 23, 295-296 (1950) *November.*

This is a brief discussion of the occurrence of moisture in coals and of the usual methods of determination. The differences are explained between moisture retained as (1) "inherent," "air dried" or adsorbed, and as (2) "free" or entrained. Methods of determination are grouped into the classes of (1) indirect, (loss of weight measurements), (2) direct (collection and measurement of eliminated water) and (3) those based on chemical or physical properties of water. The influence of sampling, temperature, atmospheric humidity, and oxidation is discussed, together with the methods of controlling these factors during the determination.

O. P. Brysch

Synthesis Gas

Garbo, P. W. (assigned to Hydrocarbon Research, Inc.) MANUFACTURE OF SYNTHESIS GAS. U.S. 2,526,652 (1950) October 24.

In the production of synthesis gas, natural gas is preheated in one zone to a temperature below about 1000°F while the oxygen-containing reactant is preheated in a second zone substantially to the reaction temperature. A granular heat absorptive material ("thermophore") is used to transfer the heat from the reactor to the two separate zones.

C. H. Riesz

Phinney, J. A. (assigned to Stanolind Oil and Gas Co.) METHOD AND APPARATUS FOR MAKING HYDROGEN-CARBON MONOXIDE MIXTURES. U.S. 2,532,514 (1950) December 5.

In the reforming of methane with air and carbon dioxide to produce hydrogen and carbon monoxide, the streams are separately preheated (above 1500°F). Carbon deposited is removed by passage of air; purging is accomplished with carbon dioxide. Two forms of apparatus are described.

C. H. Riesz

Water Gas

Sherwood, P. W. WATER GAS FROM METHANE. *Petroleum Processing* 5, 1308-1311 (1950) *December.*

Methods by which mixtures of carbon oxides and hydrogen may be obtained from methane are reviewed. Direct thermal cracking of methane to carbon and hydrogen is used mainly for carbon black production. The steam-meth-

ane reaction is used exclusively. Thermally, the reaction requires temperatures in excess of 2250°F. Catalytic reforming is now used universally in this country at temperatures ranging between 1300° and 1700°F. Nickel catalyst is contained in high-temperature alloy steel tubes exposed to external heating. The principal engineering problem involves the transfer of the endothermic heat of reaction from external sources. Addition of oxygen makes the process autothermic and several processes based on this scheme have been developed. For manufacture of ammonia synthesis gas, air can economically be used as the source of oxygen. Steam-reforming has been conducted under 450 psi pressure at the Missouri Ordnance Works at Louisiana, Mo., to take advantage of the elevated pressure at which the natural gas was received. In general, the residual methane is a function of the square of the pressure and the process is usually carried out at atmospheric pressure.

C. H. Riesz

Steinschlaeger, M. MANUFACTURE OF WATER GAS. U.S. 2,525,318 (1950) October 10.

Water gas, synthesis gas and the like are produced from coal, coke, liquid and gaseous fuels in equipment of the type used in standard carbureted water gas practice, but with some modifications in operating cycle. The invention utilizes a generator containing incandescent solid fuel for decomposing steam, and usually two regenerators; one used alternately as an air blast preheater and carbureter, the other acting alternately as a steam run preheater and blast products cooler. For producing water gas from bituminous coal an additional regenerator (three altogether) is provided for decomposing volatilized coal constituents. The principal advantages of the process of the invention are that the usual up run is not required and that both blast and make gases are passed through a waste heat boiler for steam generation. Sample calculations are given.

C. Von Fredersdorff

The following article, the abstract for which appears on the page indicated, is also called to your attention:

Wainwright, H. W. and Lambert, G. I. A COLORIMETRIC METHOD FOR THE DETERMINATION OF THIOPHENE IN SYNTHESIS GAS. p. 12

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Continuous Sampler

Hall, F. T. (assigned to Phillips Petroleum Co.) CONTINUOUS SAMPLE COLLECTING DEVICE. U.S. 2,530,463 (1950) November 21.

This invention relates to a device for sampling gas in such a way as to get a composite, representative sample. Included is the case where entrained liquid is present and where flow rate varies with time.

J. D. Parent

Dehydration

Ames, C. B. NATURAL GAS DEHYDRATION UNITS COMPLETELY ROBOTIZED. *Petroleum Engr.* **22D**, 26-28 (1950) *December.*

Transcontinental Gas Pipe Line Corp. is to have 15 dehydration plants. These plants are controlled automatically and are identical in design although they vary in size. Individual plant capacities vary from 5 to 30 MMcf per day and dry to a dew point of 25°F. Each plant consists essentially of two contactors 2 to 4 ft in diameter and 12 to 16½ ft high. Contactors are to operate on a 16 hr cycle, with 8 hrs on drying, 4 hrs on regeneration and 4 hrs on cooling. Plant pressure is 800 psi. The instrumentation is discussed in detail.

J. D. Parent

Dual Fuel Engine

NATURAL GAS FUELS DIESEL ENGINE TO FEED CITY'S POWER LINES. *Gas* **26**, 31-33 (1950) *December.*

Elkhorn, Wis. is using a dual fuel diesel engine to generate electricity. Gas is normally used, but oil is used during peak periods.

J. D. Parent

Gas Processing

Middlebrook, V. E. NATURAL GAS PROCESSING—A REVIEW OF ITS HISTORY, AND A RESUME OF CURRENT DEVELOPMENTS. *Oil Gas J.* **49**, 85-87, 107, 108 (1950) *December* 7.

This is a short but worthwhile review of processes which have been used for recovery of natural gas liquids. Included in the discussion is rich oil deethanization and the new process in which both absorption and deethanization take place in a single vessel.

J. D. Parent

Gas Treating

Kohl, A. L. GAS-TREATING PROCESS. *Oil Gas J.* **49**, 63, 64, 85-87 (1950) *November* 30.

Processes used for hydrogen sulfide removal are reviewed with particular attention given to the Girbotol and glycol-amine processes.

J. D. Parent

Helium

Cattell, R. A. and Wheeler, H. P., Jr. HELIUM AND ITS USES. *World Oil* **131**, 64, 68, 70 (1950) *December.*

The essential features of the Bureau of Mines process for producing helium from natural gas are presented. Current uses are reviewed. The price of helium is given as 1½¢ per cubic foot.

J. D. Parent

Humidification and Oil Fogging

Rogan, B. F. and Turpish, J. V. SOME ASPECTS OF HUMIDIFICATION AND OIL FOGGING OF NATURAL GAS. *Gas Age* **106**, 35, 36, 70 (1950) *December* 7.

It is difficult to humidify natural gas with some techniques as entrained droplets of water rather than true water vapor may be introduced. The former settles out in the line. The experience with oil fogging is similar. Much drops out in the nearest drip pot. Too much oil causes stoppage of appliance pilot filters.

J. D. Parent

Natural Gasoline

Armstrong, J. B. TESTING NATURAL GASOLINE PLANT OPERATING EFFICIENCY. *Petroleum Refiner* **29**, 125-128 (1950) *December.*

This paper covers testing a natural gasoline plant for efficiency of extraction of liquid products.

J. D. Parent

Pipe Lines

Sanders, F. H., Jr. DEVELOPMENTS IN LARGE-DIAMETER RIVER CROSSING CONSTRUCTION. *Pipe Line News* **22**, 18-21 (1950) *December.*

The author concludes that added weight to give about 20% negative buoyancy for river crossings is wise. Heavier steel walls or added concrete are recommended in preference to river weights which concentrate stresses. Upstream or downstream bow is recommended for streams with appreciable current. The theory as to which is better is uncertain and practical experience has not yet proved one superior to the other. Pipe should be buried deep enough to avoid trouble due to unstable, shifting bottoms.

J. D. Parent

Production

Morris, T. B. KNOW YOUR DRILL COLLAR. *World Oil* **131**, 106-108, 112, 114 (1950) *December.*

The drill collar has become one of the most expensive items to the contractor. Metallurgical factors of importance for long life of the collar are explained.

J. D. Parent

Smith, B. B. SURFACE CASING FAILURES. *World Oil* **131**, 129, 130 (1950) *December.*

In recognition of the increasing amount of surface casing failures encountered by the drilling industry, the author analyzes possible causes of failure in surface strings and points to preventative measures.

Author's abstract

Underground Storage

Wagner, H. J. UNDERGROUND STORAGE OF NATURAL GAS IN THE APPALACHIAN AREA. *World Oil* 131, 60-62 (1950) *December.*

Underground storage of natural gas in Appalachian gas fields is discussed. Analysis of cost data for one company indicates a storage cost of 7½¢/Mcf. This figure includes 6% return on investment and carrying charge for cushion gas, in addition to operating charges.

J. D. Parent

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

De Carlo, J. A. and Corgan, J. A. THE POSSIBLE EFFECT OF THE EXPANDING USE OF NATURAL GAS ON THE PRODUCTION OF COKE AND COAL CHEMICALS IN THE UNITED STATES. p. 4

Hutchinson, A. J. L. A SYSTEM OF PROCESS CALCULATIONS FOR LIGHT HYDROCARBONS. PART III. ABSORPTION. p. 14

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Fischer-Tropsch Synthesis

Frankenburg, W. G. (assigned to Hydrocarbon Research, Inc.) CATALYTIC REDUCTION OF CARBON OXIDE BY HYDROGEN. U.S. 2,531,420 (1950) November 28.

Catalysts containing nitrides of a transition element of Groups IVa, Va, VIa and VIIa of the periodic table may be used for the synthesis of liquid hydrocarbons from carbon monoxide and hydrogen. Tungsten nitride and titanium nitride are claimed specifically.

C. H. Riesz

Hemminger, C. E. (assigned to Standard Oil Development Co.) HYDROCARBON SYNTHESIS AND THE METHOD OF PREPARING THE CATALYST. U.S. 2,527,130 (1950) October 24.

An improved iron catalyst for the hydrogenation of carbon monoxide into valuable products is prepared by incorporating 2 to 20% by weight of silicon in an iron-type catalyst promoted with 0.1-10% of an alkali metal compound.

C. H. Riesz

Holder, C. H. (assigned to Standard Oil Development Co.) HYDROCARBON SYNTHESIS. U.S. 2,530,243 (1950) November 14.

In the synthesis of hydrocarbons from carbon monoxide and hydrogen, fluidized iron catalyst particles accumulate carbon which increases their buoyancy. These more buoyant particles are removed in an upper packed section of the reactor for regeneration.

C. H. Riesz

Martin, H. Z. (assigned to Standard Oil Development Co.) FLUIDIZED HYDROCARBON SYNTHESIS PROCESS. U.S. 2,530,977 (1950) November 21.

The conversion of carbon monoxide and hydrogen into hydrocarbons is improved by addition to the catalyst of 10-50% by weight of an adsorbent to assist in the removal of the water formed in the process. The adsorbent is regenerated by passing a dry, non-oxidizing gas through the catalyst-adsorbent mixture.

C. H. Riesz

Vesterdal, H. G. (assigned to Standard Oil Development Co.) SYNTHESIS OF HYDROCARBONS IN THE PRESENCE OF AN IRON TYPE CATALYST. U.S. 2,533,071 (1950) December 5.

A catalyst for the synthesis of products from carbon monoxide and hydrogen comprises 0.2 to 1% of carbonyl iron deposited on zinc-alumina spinel ($ZnO \cdot Al_2O_3$) and containing 0.5 to 10% of potassium carbonate. Iron carbonyl vapors may be led into a bed of promoted spinel fluidized by non-oxidizing gases at 400-1000°F causing decomposition of the iron carbonyl.

C. H. Riesz

Voorhies, A., Jr. (assigned to Standard Oil Development Co.) HYDROCARBON SYNTHESIS. U.S. 2,533,072 (1950) December 5.

Fluidized iron catalyst, carbonized through use in the synthesis of products from carbon monoxide and hydrogen, is regenerated in a separate reaction chamber by hydrogenation

of the carbon at 1000-1100°F. Controlled amounts of carbon monoxide are added with the carbonized catalyst to assist in maintaining the desired reaction temperatures.

C. H. Riesz

Watts, R. N. (assigned to Standard Oil Development Co.) HYDROCARBON SYNTHESIS WITH SPHERICAL CATALYST PARTICLES. U.S. 2,530,344 (1950) November 14.

Hydrocarbons are synthesized from carbon monoxide and hydrogen through use of fluidized iron microspheres. The spheres are further characterized as being 20 to 200 microns in diameter with an oxidized iron surface of less than 20 microns and having an unoxidized solid iron core. See next abstract of U.S. 2,530,345.

C. H. Riesz

Watts, R. N. (assigned to Standard Oil Development Co.) PREPARATION OF A SPHEROIDAL FISCHER-TROPSCH CATALYST. U.S. 2,530,345 (1950) November 14.

Iron microspheres, suitable for use as a catalyst for the synthesis of liquid hydrocarbons from carbon monoxide and hydrogen, are prepared through use of a metallizing gun. The spherical particles pass through an oxidizing atmosphere (5-60% oxygen) and then are quenched in water. The outer layers (3-20 microns) are oxidized while the cores are substantially pure iron. Promoter, such as potassium carbonate, may be added in a coating on the iron wire fed to the metallizing gun, in the quenching solution, or after quenching, by impregnation.

C. H. Riesz

Wirth, G. THE EVALUATION OF CONVERTERS FOR EXOTHERMIC AND ENDOTHERMIC CATALYTIC REACTIONS OCCURRING WITHIN NARROW TEMPERATURE LIMITS. U.S. Bureau of Mines Information Circular 7587 (1950) November. (Translation of Technical Oil Mission Reel 134, Section I-B, Item 37, Leuna, July 4, 1942. by R. C. Grass and H. J. Kandiner.)

The performance of catalytic reactors of types used in German Fischer-Tropsch plants are calculated and compared from a mathematical analysis of heat transfer relations. Simplifying assumptions used include (1) heat generation per unit volume of catalyst is constant, and (2) heat generated is removed completely through the walls.

C. H. Riesz

Fluid Cracking Catalyst

Viland, C. K. GRAVITY SEPARATION OF INACTIVE CATALYST. *Oil Gas J.* **49**, 74-75, 78-80 (1950) *November* 30.

Fluid cracking catalysts become heavier as they age, due to physical changes attendant to loss in surface area and metal contamination. A gravity-classification system has been installed in the fluid catalytic cracking unit of the Tide Water Associated Oil Co. at Avon. A centrifugal separator followed by a classification table processes 50 tons per day of the catalyst inventory and rejects 4.7 tons, equivalent to 9.3% of the feed to the system. The procedure was found ideally suited to reject natural catalyst when it was desired to replace part of the catalyst inventory with synthetic catalyst of low density. Later, it was found advantageous to use a newly-developed, low-iron, sulfur-resistant natural (halloycite) cracking catalyst. Currently, the older type of montmorillonite natural catalyst is being selectively rejected. It is planned to operate with a two-component catalyst inventory, the less expensive sulfur-resistant natural catalyst being used to eliminate heavy metallic contaminants while product distribution is controlled through additions of synthetic catalyst.

C. H. Riesz

Sweetening

Kalichevsky, V. A. SWEETENING AND DESULFURIZATION OF LIGHT PETROLEUM PRODUCTS. PART II. ANALYSIS OF SULFUR COMPOUNDS IN LIGHT PETROLEUM DISTILLATES. *Petroleum Refiner* **29**, 113-115 (1950) *December.*

Various methods of analysis for sulfur constituents in light petroleum distillates are reviewed.

C. H. Riesz

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Boyd, J. PETROLEUM INDUSTRY HAS DEFINITE ROLE IN SYNTHETICS DEVELOPMENT. p. 2

Garbo, P. W. MANUFACTURE OF SYNTHESIS GAS. p. 7

Phinney, J. A. METHOD AND APPARATUS FOR MAKING HYDROGEN-CARBON MONOXIDE MIXTURES. p. 7

Ragatz, E. G. EFFICENCY CHARACTERISTICS OF COMMERCIAL ABSORBERS. p. 14

Rollman, W. F. METHOD OF PRODUCING A CARBON MONOXIDE AND HYDROGEN GAS MIXTURE FROM CARBONACEOUS MATERIALS. p. 5

Shapleigh, J. H. METHOD OF CRACKING HYDROCARBONS. p. 4

7. ANALYTICAL METHODS AND TESTS

Gas Analysis

Yant, W. P., Cotabish, H. N. (assigned to Mine Safety Appliances Co.) METHOD AND APPARATUS FOR GAS ANALYSIS. U.S. 2,531,592 (1950) November 28.

A combustible gas detector based on measurement of temperature rise caused by catalytic oxidation of combustible constituents in air or gaseous atmospheres is described. Special emphasis is placed on application of this instrument to the determination of carbon monoxide in contaminated atmospheres such as might exist within aircraft. A principal feature of the invention is provision for the apparatus to operate substantially independent of the water vapor content of the atmosphere being tested. The instrument is portable and is purported to be compact, sturdy, light in weight, and capable of providing means for quickly, reliably and automatically determining the presence and amounts of combustibles, specifically carbon monoxide in air in concentrations as low as 0.005 to 0.007 per cent.

H. Hakewill

Thiophene in Synthesis Gas

Wainwright, H. W. and Lambert, G. I. A COLORIMETRIC METHOD FOR THE DETERMINATION OF THIOPHENE IN SYNTHESIS GAS. U.S. Bureau of Mines Report of Investigations 4753 (1950) November.

A study of the isatin method was conducted for the purpose of evaluating variables encountered in determining thiophene colorimetrically by spectrophotometric measurement of the blue coloration imparted to isatin-H_2SO_4 reagent as thiophene and isatin which are combined to form indophenine. Variables investigated included: aging of reagent, temperature, influence of oxidizing agents, and interference due to the presence of CS_2, C_2H_5SH, and olefins. A procedure was developed for carrying out the analysis, and its applicability to synthesis gas containing low concentrations (less than 2%) of olefins was proved valid. The authors claim that as little as 0.0001 grain of thiophene sulfur per 54.5 ml of test reagent can be detected by determination of color intensity with a Beckman spectrophotometer at a wave length of 580 millimicrons using a 10 mm light path.

H. Hakewill

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Barber, E. G. THE DETERMINATION OF MOISTURE IN COAL. p. 7

Kalichevsky, V. A....PART II. ANALYSIS OF SULFUR COMPOUNDS IN LIGHTER PETROLEUM DISTILLATES. p. 11

8. GENERAL AND PHYSICAL CHEMISTRY

Carbon Monoxide

Glockler, G. THE HEAT OF DISSOCIATION OF CARBON MONOXIDE. *J. Chem. Phys.* 18, 1517-1518 (1950) *November.*

Consideration of the heats of formation and the spectrum of CO as well as the heat of dissociation of O_2 leads to a value for dissociation of CO which casts some doubt on recent determinations of the sublimation heat of carbon. The data for CO are used as a basis for the construction of a CO energy diagram.

S. Katz

Cool Flames

Malherbe, F. E. and Walsh, A. D. EXPERIMENTS WITH COOL FLAMES. I. INDUCTION PERIODS. *Trans. Faraday Soc.* (British) 46, 824-834 (1950) *October.*

Experimental studies of the low temperature oxidation reaction referred to as "cool flames" are described. These include work with n-butane, n-pentane and n-hexane. Existing theories of the origins of cool flames based on a temperature and pressure dependent induction period are rejected, and, instead, a theory is proposed based on the occurrence of branched-chain reactions.

S. Katz

Malherbe, F. E. and Walsh, A. D. EXPERIMENTS WITH COOL FLAMES. II. PRESSURE-TEMPERATURE LIMITS. *Trans. Faraday Soc.* (British) 46, 835-848 (1950) *October.*

The pressure-temperature plots of the cool flame limits of a number of hydrocarbons (propane, butane, heptane, and hexane) and diethyl ether have been examined and the composite nature of these curves has been established. This is probably a reflection of the composite nature of the branching effect responsible for the occurrence of the cool flame, i.e., at different pressures and temperatures the mechanism of chain branching alters, leading to alterations in the shape of the cool flame boundary curve.

S. Katz

Diffusion Flames

Wolfhard, H. G. and Parker, W. G. INFLUENCE OF SULFUR ON CARBON FORMATION IN DIFFUSION FLAMES. *Fuel* (British) 29, 235-240 (1950) *October.*

A spectroscopic study of hydrocarbon diffusion flames shows that when sulfur dioxide is introduced into either the fuel or oxygen stream of a diffusion flame a variety of readily identifiable sulfur compounds form in the flame. Combustion of carbon with sulfur reduces the luminosity of the flame. The effect of sulfur trioxide is similar, in contrast to its behavior in premixed gas flames where carbon formation is promoted.

S. Katz

Equation of State

Wentorf, R. H., Buehler, R. J., Hirschfelder, J. O. and Curtiss, C. F. LENNARD-JONES AND DEVONSHIRE EQUATION OF STATE OF COMPRESSED GASES AND LIQUIDS. *J. Chem. Phys.* 18, 1484-1500 (1950) *November.*

An equation of state using the two parameters, the maximum potential energy of interaction, and the low temperature collision diameter is presented. Thermodynamic properties of various nonpolar substances are calculated from it and compared to their experimental values. Data for the two force constants are obtained from viscosities of the corresponding substances. The authors refined the LJD equation further by including the energies of interaction of second and third shells of molecules that surround the potential energy cage.

S. Mori

Raman Spectra

Cleveland, F. F. and Porcelli, P. RAMAN SPECTRA OF HYDROCARBONS. N-HEXANE, N-HEPTANE, 2-METHYLPENTANE, 3-METHYLPENTANE, 2,4-DIMETHYLPENTANE, AND 2,3-DIMETHYLBUTANE. *J. Chem. Phys.* 18, 1459-1461 (1950) *November.*

Raman displacements and relative intensities were measured for liquid n-hexane, n-heptane, 2-methylpentane, 3-methylpentane, 2,4-dimethylpentane and 2-3 dimethylbutane. Previous data have been collected for comparison with the present results, and most probable values are indicated.

S. Katz

Surface Area

Carman, P. C. and Malherbe, P. le R. ROUTINE MEASUREMENT OF SURFACE OF PAINT PIGMENTS AND OTHER FINE POWDERS. I. *J. Soc. Chem. Ind.* (British) **69**, 134-143 (1950) *May.*

The introduction of a term for slip flow and molecular flow into the Kozeny equation for gas permeability is described. An apparatus and procedure for gas permeability studies of surface area is discussed. It is concluded that while less accurate than adsorption studies, the method is quick, simple and reasonably reliable.

S. Katz

The following article, the abstract for which appears on the page indicated, is also called to your attention:

Rollman, W. F. METHOD OF PRODUCING A CARBON MONOXIDE AND HYDROGEN GAS MIXTURE FROM CARBONACEOUS MATERIALS. p. 5

10. CHEMICAL ENGINEERING

Absorbers

Ragatz, E. G. EFFICIENCY CHARACTERISTICS OF COMMERCIAL ABSORBERS. *Petroleum Refiner* **29**, 117-124 (1950) *December.*

Ragatz proposes use of his absorption efficiency chart to study tray efficiency and thereby arrive at more efficient design.

J. D. Parent

Absorption

Hutchinson, A. J. L. A SYSTEM OF PROCESS CALCULATIONS FOR LIGHT HYDROCARBONS. PART III. ABSORPTION. *Petroleum Refiner* **29**, 97-103 (1950) *December.*

The Kremser-Brown analysis is presented. It is also given in a revised form which allows for variation of liquid and vapor rates through the column.

J. D. Parent

Air Flow

Rothfus, R. R., Monrad, C. C. and Senecal, V. E. VELOCITY DISTRIBUTION AND FLUID FRICTION IN SMOOTH CONCENTRIC ANNULI. *Ind. Eng. Chem.* **42**, 2511-2520 (1950) *December.*

Velocity distribution and friction effect were studied for the flow of air through the annular space between concentric tubes. Lamb's equation for velocity distribution was confirmed for streamline flow. Friction factors for turbulent flow are greater than those predicted on the bases of hydraulic radius. Useful correlations are presented.

J. D. Parent

Azeotrope

Calingaert, G. and Wojciechowski, M. AN AZEOTROPE BETWEEN PARAFFIN HYDROCARBONS. *J. Am. Chem. Soc.* **72**, 5310-5311 (1950) *November.*

Deviations from ideality caused by dissimilarity of species makes azeotropism possible. The dissimilarity need not be great for azeotropy (formation of constant boiling mixtures) to exist provided vapor pressures are close. Hydrocarbon mixtures may form azeotropes. Benzene and cyclo-hexane, which are close in boiling point, form such a system. Even where both species are paraffins there are cases where azeotropes form.

J. D. Parent

Catalytic Reactions

Sliepcevich, C. M. and Brown, G. G. CATALYTIC REACTIONS AT HIGH PRESSURES AND TEMPERATURES. *Chem. Eng. Progress* **46**, 556-562 (1950) *November.*

This paper deals mainly with the design and operating of a continuous, small-scale catalytic reactor suitable for use at 1200°F and 10,000 psi. The operation of the reactor is illustrated with studies of the decomposition of butanol-1 over a silica-alumina catalyst at 760°F and pressures between atmospheric and 9000 psi. Experimental details are given and a discussion of the effect of pressure on the reactor is included.

S. Katz

Distillation

Cichelli, M. T., Weatherford, W. D., Jr., Bowman, J. R. and Coull, J. BINARY BATCH DISTILLATION. *Ind. Eng. Chem.* **42**, 2502-2510 (1950) *December.*

The previously developed concept of pole height is shown to give conservative results. By means of the Smoker equation, the relationship between number of plates, reflux ratio, and pole height is shown at conditions other than the limiting cases of infinite plates and total reflux. Pole height is an index characterizing the sharpness of separation, and is the product of the slope of the batch distillation curve at $x_0 = 0.5$ times the fraction of the charge remaining in the pot when $x_0 = 0.5$. Relations between pole height, reflux ratio, and number of theoretical plates are presented as curves. Applications to distillation problems are given.

C. L. Tsaros

Rose, A. and Williams, T. J. PUNCHED CARD DEVICES FOR DISTILLATION CALCULATIONS. *Ind. Eng. Chem.* **42**, 2494-2497 (1950) *December.*

Punched card computers were used successfully for plate-to-plate calculations of binary and ternary steady-state continuous distillations when simplifying assumptions are applicable, and for stepwise plate-to-plate calculations with appreciable holdup. Methods are described for extending the procedures to cases where simplifying assumptions are not applicable. The use of the computers greatly speeds up calculation and reduces the labor and chances of error in complex calculations.

Authors' abstract

Heat Transfer

Leva, M. PACKED-TUBE HEAT TRANSFER. *Ind. Eng. Chem.* **42**, 2498-2501 (1950) *December.*

Data on heat transfer to packed tubes were presented. Most of the data were taken where the particle diameter was greater than one-third the diameter of the tube. The heat transfer results were correlated as Nusselt numbers against Reynolds numbers. The pressure drops over the tubes were measured and reported.

R. E. Peck

Material and Heat Balance Calculation

Farrar, G. L. MATERIAL AND HEAT BALANCE CALCULATIONS. *Petroleum Engr.* **22C**, 20, 22, 24, 26-28 (1950) *December.*

The values of periodic heat and material balance calculations in checking the performance of a unit or process are discussed. This is essential to the determination of the amounts of heat and material that are lost in processing, so that unit cost of product can be established and maintained at its lowest level. The steps in the making of balances and the required physical data are discussed. Five examples of heat and material balances are given.

C. L. Tsaros

Oxygen Production

Crawford, D. B. (assigned to Elliott Co.) METHOD AND APPARATUS FOR SEPARATING MIXED GASES. U.S. 2,526,996 (1950) October 24.

Eighteen claims are granted for the Elliott system for the production of liquid and gaseous oxygen of high and intermediate purity. Several improvements and advantages over conventional processes are claimed, namely (a) nearly complete recovery of oxygen from the air feed, (b) low pressure operation requiring only a simple rectification column, and (c) essentially complete removal of water vapor and hydrocarbons from the air feed by a clean-up system comprising silica gel absorbers and reversing regenerative heat exchangers.

C. Von Fredersdorff

Spray Towers

Bonilla, C. F., Mottes, J. R. and Wolf, M. AIR HUMIDIFICATION COEFFICIENTS IN SPRAY TOWERS. *Ind. Eng. Chem.* **42**, 2521-2525 (1950) *December.*

A study of the performance of three hollow-cone spray nozzles was made using a counter-flow spray tower 3 ft in diameter and 7 ft high. The orifices of the three nozzles were $\frac{1}{16}$ in., $\frac{3}{32}$ in., and $\frac{1}{8}$ in. Only a single nozzle, mounted at the top of the tower, was used, and mass transfer coefficients for the air-water system

were determined. The effects of gas mass velocity, liquid rate, and distance of the nozzle from the air inlet were studied. An equation of $k_g a$ as a function of these variables was developed for each nozzle. Extensions of these equations to larger towers and to other systems is discussed.

C. L. Tsaros

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Low Pressure Measurement

INSTRUMENTS ON THE MARCH. DIAPHRAGM-TYPE MICROMANOMETER WITH ELECTRICAL PICK-UP. *Instruments* 23, 1136, 1172, 1174 (1950) *November.*

A diaphragm-type micromanometer, utilizing an electrical pick-up, has been developed at the National Bureau of Standards to measure differential pressures in the micron region. Constructed for use with a mass spectrometer, the micromanometer gives rapid direct readings of pressure on a microammeter scale over the range of one to one hundred microns. An accuracy of 0.1 micron on a fifty micron scale is claimed.

D. V. Kniebes

Orifice Meter Installations

Cunningham, L. V., Jr. PRECISION AND ACCURACY OF ORIFICE-METER INSTALLATIONS. *Mech. Eng.* 72, 979-983 (1950) *December.*

A description is given of an installation where two orifice flow meters were installed in series and used to meter light hydrocarbon flow. It was concluded that the precision of orifice meter installations can be maintained over long periods of time with proper maintenance. The average deviation between the meters was 0.1 to 0.5%, and the average accuracy was within 1%. The measurements on the dual orifice meters were more precise than those of the gages on the water calibrated receiving drums on the same stream.

W. J. Merwin

Thermometer

Barthel, A. A PLATINUM RESISTANCE THERMOMETER FOR TEMPERATURES UP TO 750°C. *Engrs.' Digest* 11, 386-387 (1950) *November.*

The use of a platinum resistance thermometer at temperatures up to 750°C is described. The increased range is made possible by replacing the glass resistance element support with a ceramic support. It is noted that polarization effects, due to conductivity of the mounting assembly have no disturbing effects with the modified thermometer, and also that the response time is slightly improved.

S. Katz

12. MATERIALS OF CONSTRUCTION

Corrosion

Goodwin, C. L. DEVELOPMENTS IN COATINGS AND CATHODIC PROTECTION. *Petroleum Engr.* 22D, 35-37 (1950) *December.*

Present day practice dictates the use of pipe line coatings plus cathodic protection to provide corrosion protection at a minimum cost. New coating materials at present under test include a cold-applied mastic composed of reclaimed synthetic rubber and an enamel produced by reacting asphalt and resinous materials. Oil-immersed dry-type rectifiers have been the most successful and dependable. Under development is a ceramic container for anodes which will permit anode replacement without excavation. New improvements in galvanic anode installations have stressed packaged anodes, small portable excavating equipment and thermite welding of anode connections to pipe.

B. E. Hunt

Lauderbaugh, A. B. ILLUSTRATIONS OF GALVANIC CORROSION GIVEN IN TABLOID PRIMER. *Am. Gas J.* 173, 26-30 (1950) *December.*

Illustrated examples of some of the various causes of galvanic corrosion are given. Examples of mitigation methods are also given.

B. E. Hunt

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